The Nutritional Aspects of Milk Pasteurization*

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THE evidences of animal experiment do not show any differences between raw and pasteurized milks.

The actual changes in milk caused by pasteurization are an increase in insoluble calcium of about 6 per cent, a reduction of iodine content by 20 per cent, and considerable destruction of vitamin C. Certain animals have a higher need for calcium than do infants and it may be that raw milk would be better for them than pasteurized milk, but there is no evidence that this is true for children. There is no convincing evidence that raw milk, even if it were safe, is superior to pasteurized milk in infant feeding. Pasteurized milk is probably better since it is more easily digested. The growing practice by pediatricians of boiling milk or of feeding evaporated milk to infants, shows that it is certainly satisfactory. The idea of splitting hairs over slight assumed differences is absurd. We should allow a reasonable margin of safety over the minimum nutritive requirements in child feeding, and this is best accomplished by giving a liberal allowance of milk.

The heating of milk is so great a safety factor in preventing disease that there should no longer be any argument about the superiority of raw milk.

We have an immense amount of clinical evidence gathered from many countries which shows that pasteurized milk has fulfilled the needs for feeding infants and children over many years, with no evidence of damage, provided the loss of vitamin C is made good. The opponents of pasteurized milk have conspicuously failed to make a case against it in favor of the raw product. The marked lessening of incidence of intestinal troubles and contagious diseases carried by raw milk through pasteurization makes it hard to understand how opposition can longer be justified.

It is well known that milk is deficient in iron and in ascorbic acid, and perhaps also in copper, although during pasteurization it probably becomes sufficiently enriched in this element. But we no longer judge a food on the basis of what it lacks. We stress the importance and significance for health of making proper combinations of foods so as to secure effective supplemental effects. No baby intelligently managed is now fed milk alone for any considerable period. It is given cod liver oil and fruit juices early, and supplementary foods as it grows. The problems of feeding normal infants are now satisfactorily solved.

The only recent reports of nutrition experiments which show inferiority of sterilized as compared with pasteurized and raw milk are those of E. C. V. Mattick, and J. Golding, in England, who observed that rats fed biscuit made

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of white flour and water, supplemented with milk, either raw or pasteurized, grew normally and reproduced normally, whereas those fed the same biscuit supplemented with sterilized milk failed in reproduction, and of the original rats many failed to reach maturity. Their results seem to differentiate markedly between pasteurized and sterilized milks in their nutritive properties, especially in respect to power to support reproduction.

I have never been much impressed by these experiments for they were not planned in a manner to yield information which could be applied to human experience with diet. It is one thing to demonstrate that a simple mixture of biscuit and sterilized milk is less effective nutritionally than the same mixture with raw milk, and another to translate the condemnation of pasteurized milk used in an entirely different manner in the human diet where it is supplemented with foods more effective as sources of nutriments than white bread biscuit. The fact is that even in these English experiments, pasteurized milk was not shown to have undergone any appreciable deterioration, even when tested in so restricted a manner. No effective supplementary foods were studied in combination with the sterilized milk.

The experience of numerous investigators, including the present writer, and covering many years of studies with animals, shows that pasteurized milk, milk powders and evaporated milks, are essentially the equivalents of raw milk in nutrition. The differences between them is not sufficient to warrant serious consideration. Furthermore, the experience of the pediatric profession with sterilized milk has abundantly demonstrated that excellent results can be secured in infant feeding when such milk is properly supplemented with a fruit juice and cod liver oil and the infant receives supplementary feeding with appropriate additions as it advances in age. The safety factor afforded by sterilizing milk as a safeguard against infections is so great that there is no question about the wisdom of this system of feeding.

The Lanarkshire, Scotland, study of 10,000 children receiving three-quarters of a pint each daily—5,000 raw, grade A milk and 5,000 pasteurized milk—with 10,000 as controls, gave clear evidence of the beneficial effect of milk feeding on the rate of growth. There was no difference in the raw and pasteurized milks (*J.A.M.A.*, 96:1243, 1931).

Scheunert and Bischoff (*Biochem. Zeitschr.*, 219:186, 1930) studied the food value of raw and heated milk, and found no detectable change in food value. These experiments furnish cogent evidence that cooking (foods other than milk as well as milk) as ordinarily practised, does not interfere with its usual influence on cell metabolism or prevent its utilization for such characteristic demands as growth and reproduction.

In a letter from Lord Dawson of Penn, to the Editor of the *Lancet*, December 13, 1930 (*A.J.P.H.*, 21:389, 1931), he states that pasteurization of milk should be universally recognized.

The Scottish experiment reported here is commented upon by the Editor of the JOURNAL (*A.J.P.H.*, 19:415, 1919):

> The campaign for the increased use of milk by children and adults is based on sound facts. We still need to push our efforts for clean milk, and we should draw distinction between pasture milk and stall-fed milk, which does not have the same values unless the stall-fed animals are specially dieted.

Fortunately we now have available an excellent study by Leslie C. Frank and others of the U. S. Public Health Service, which should finally silence the critics of pasteurized milk. These

investigators studied children fed raw and heated milk, supplementing the diets ordinarily received by American children in 39 cities and in 10 states. The children to the number of 3,700 were from 10 months to 6 years old. The report states:

> The growth-promoting capacity of heated milk plus the supplementary diet received by the average American child of 10 months to 6 years is not measurably less than the growth-promoting capacity of raw milk plus the supplementary diet received by the average American child of 10 months to 6 years.

Analyzing their data they report that there were 32 cases of diphtheria among 1,875 children who received heated milk only, against 40 among the 1,762 children fed predominantly on raw milk, case rates of 17.1 and 22.7 per 1,000 respectively. For scarlet fever, the group fed heated milk showed 43 cases against 73 for the raw milk group, case rates of 23.0 and 41.4 per 1,000 respectively.

Intestinal disturbances reported, such as diarrhea, dysentery, flux, colitis, and summer complaint, amounted to 426 for the heated milk group against 491 for the raw milk group, case rates of 227.0 and 278.0 per 1,000 respectively. When diarrhea was excluded on the assumption that many mild cases were due to causes other than milk, the incidence of intestinal diseases amounted to 208 for the heated milk group against 395 for the raw milk group, case rates of 111.0 and 196.0 per 1,000 respectively. Fifty-nine cases of rickets were diagnosed in the heated milk group against 90 cases in the raw milk group, case rates of 31.5 as against 51.1 per 1,000. The results as they relate to rickets are accounted for by the observation that more of the heated milk-fed children were given cod liver oil than was the case of those fed raw milk. Of the heated milk-fed children 41.6 per cent were given some cod liver oil as against 27.6 per cent of those fed raw milk. The average weight of the children in the two groups was 33.6 and 33.2 lb. respectively for those fed heated and raw milk. There were no significant differences in the heights of the children of the two groups, *i.e.*, 37.5 and 37.4 respectively. The report shows a significantly higher incidence of diphtheria, scarlet fever, and intestinal disturbances. The report does not consider tuberculosis, but there is strong evidence that this disease has a lower incidence in cities where almost all the milk is pasteurized.

Since the effect of pasteurization on the food value of milk is too slight to be apparent even in specially designed experiments, and is not apparent in observations on children living under ordinary American conditions, there is no valid argument which can be brought forward in support of the marketing of raw milk for the general population. It is granted that certified milk is as safe as any ordinary foods, but if the optimum amount of milk is to be consumed by the public the price must be made as low as is consistent with the maintenance of high quality. The only method of accomplishing this objective, which has the full approval of public health officials and bacteriologists, is pasteurization of the milk supply.

It seems strange indeed that, when we accept so generally the cooking of most of our foods, there should still remain in certain areas a serious objection to the milk heat treatment of milk involved in pasteurization. The menace of bovine tuberculosis to the health of children is so great that universal pasteurization would be imperative if only for the prevention of the spread of this disease alone among children.